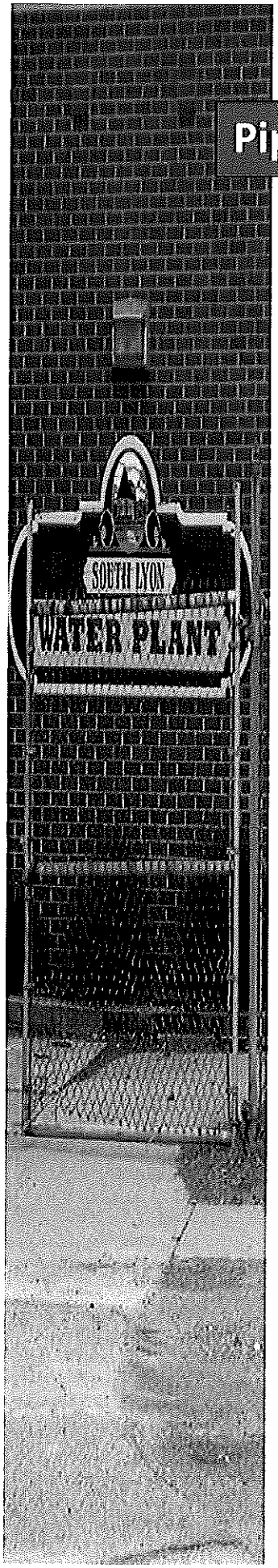


DWRF Green Project Reserve
City of South Lyon (DWRF #7314-01)

Pipe Replacement

Summary

- Replacement of approximately 12,000 feet of 4-inch and 26,000 feet of 6-inch pre-1950 cast iron water main with 38,000 feet of 8-inch ductile iron (DI) water main to eliminate the loss of 9.0 million gallons of water per year (MGY)
- Total DWRF Loan Amount = $6,260,000
- Water Main Replacement (green) portion of loan = $5,778,000 (92% of total loan)
- Annual water savings = 9.0 million gallons (MG)

Background

- The South Lyon Water Treatment Facility (SL-WTF) was brought online in 1965 with upgrades and expansions in 1970, 1980, 1996 and 2000. The distribution system dates back to the early 1900s and includes approximately 55 miles of pipe ranging in size from 4 to 24 inches in diameter. The SL-WTF processes an average of 1.4 million gallons per day (MGD) or 500.0 million gallons per year (MGY).
- A comprehensive history of the size, location and year of water main breaks has been catalogued for the last 10 years. This history indicates that 20 water main breaks have occurred in the 4-inch and 6-inch mains to be replaced.
- This history indicates that the 4-inch and 6-inch mains to be replaced incurred a disproportionately high percentage of breaks compared to the overall system.
- The 4-inch and 6-inch mains to be replaced account for 13% (7 miles) of the 55 miles of distribution pipe. This project will replace 38,000 feet 4-inch and 6-inch cast iron pipe with 8-inch DI pipe.

Results

- The water system had 45 total water main breaks from 2000 – 2009.
- The water system had 20 water main breaks from 2000 – 2009 in the 4-inch and 6-inch lines to be replaced as part of this project.
- The percentage of breaks in the lines to be replaced = 20/45 = 44.4%
- Average volume of water lost per water main break is 4.5 MG.

To Calculate Water Loss

- To calculate the amount of water that has been lost in the lines to be replaced, multiply the number of breaks by the water lost per break.

  (20 breaks) * (4.5 MG/break) / (10 years) = 9.0 MGY

- To calculate overall system water loss per year, subtract the water pumped from the water billed.

  (499.8 MGY pumped) - (445.7 MGY billed) = 54.1 MGY lost

- The 9.0 MGY of water loss from the mains to be replaced represents 16.6% of the total water loss of the system: 9.0/54.1 = 16.6%

Conclusion

- By replacing the 38,000 feet of 4-inch and 6-inch pipe the system anticipates saving 9.0 MGY. The cost to pump/treat water is $1.77 per 1,000 gallons. Annual cost savings from replacement is estimated at 9.0 MG * $1.77/1000 gallons = $15,930.
- Additional benefits include increased pumping efficiency through new mains, reduction in unnecessary pumping and operation expenses, reduction in maintenance expenses, reduction in energy use and gas use, and elimination of health hazards associated with waterborne pathogens entering the system.

Drinking Water Revolving Fund
Green Project Reserve Qualification Template

Applicant: City of South Lyon Project No: 7314-01
Project Name: DWRF Water Main Improvements - Segment 1

Identify by page number from the project plan, or attach excerpts, where water efficiency or energy efficiency improvement justification is provided or discussed to support the need for the recommended green project reserve component: Pages Please see attached.

Please ensure all requested information is provided to enable an assessment by the Michigan Department of Natural Resources and Environment (DNRE) of whether the project or project component can qualify for funding from the green project reserve.

Meter Replacements with Conventional Meters

1. Over the last five years, water lost or unaccounted for in the system has averaged _____ gallons per year and is _____ percent of the water produced each year.

2. Identify the source of this information (i.e. water audit, water conservation study, production and billing records):_____

3. Identify the portion of the water loss that is likely due to inaccurate meters:_____

4. The expected reduction in water loss by installing replacement traditional water meters in all or a portion of the system is _____gallons per year, reducing the water loss percentage to _____.

5. It takes _____kilowatt hours (kWh) of electricity to produce and distribute 1,000 gallons of water. At a cost of $_____per kWh, the estimated annual electrical cost for the water loss due to inaccurate meters based on the five-year average is $_____.

6. Based on the average cost per year for the loss and the estimated cost of_____ for replacing the meters, the project will pay for itself in _____months/years.

7. Attached all relevant data and calculations that were used to provide answers to these questions.

Water Main Replacement

1. Over the last ten years, 20 water main breaks have occurred on the water mains that are proposed for replacement, an average of 0.28 breaks/mile/year.

2. Identify the length, diameter, age and type of pipe to be replaced: 12,000 feet of 4-inch

and 26,000 feet of 6-inch pre-1950 cast iron water main.

3. Each break is estimated to result in the average loss of 4.5 million gallons of water, calculated to total 9.0 million gallons/year of water lost for those water mains.
4. Present the data indicating how this is a significant source of water loss in the system and how the pipes proposed for replacement are likely to generate the greatest return in leak reduction. Please see attached.

5. The energy savings from pumping/delivering water through the new water mains versus the old ones is estimated at 13,500 KwH/year.

6. Describe the condition of the replaced mains with respect to friction/head loss etc from tuberculation or other deterioration issues. As appropriate, identify if the soils are corrosive and contributing to the deterioration/breaks or leaks in the mains, and how the replacement mains are designed to address future corrosion:
Please see attached.

7. Total projects costs for the water main replacement component of the project are $ 5,778,000.

8. Identify the source of data used for these calculations: City of South Lyon Water Dept. billing data and Dept. of Public Works water main records.

Submitted by:

Jesse B. VanDeCreek, P.E.
Name

August 13, 2010
Date

Associate
Title

Drinking Water Revolving Fund
Green Project Reserve Qualification Template

City of South Lyon
DWRF Water Main Improvements – Segment 1
Project No. 7314-01

Supplemental Information

4. The 4-inch and 6-inch water mains proposed for replacement constitute approximately 13% of the 55 miles of total distribution mains in the City of South Lyon.

During the period from 2000 – 2009, 45 water main breaks occurred in the distribution mains. Of these 45 breaks, 20, or 44% of the breaks occurred in the 4-inch and 6-inch mains proposed for replacement.

Data indicates that an average of 4.5 MG of water is lost per water main break. Therefore, for the 20 breaks in the 4-inch and 6-inch mains, approximately 90.0 MG of water has been lost over the last 10 years.

This history indicates that a disproportionately high percentage of breaks have occurred in the 4-inch and 6-inch mains during the last 10 years. Replacement of these pipes would prevent the greatest amount of breaks and would therefore generate the greatest return in leak reduction.

6. The water mains proposed for replacement are 4-inch and 6-inch cast iron pipes which have been in service for over 60 years. As a result, the City of South Lyon has experienced issues with the distribution system reliability. The City has an iron removal treatment process to minimize hardness, taste and odors from the water. The process involves an Ortho-Phosphate additive to suspend particle matter. This matter attaches to the interior walls of the mains, causing scaling which reduces the cross-sectional area of the mains. Additionally when a water mains breaks or a hydrant or gate valve is opened, this matter dislodges from the main walls producing cloudy, red water.

The chemical conditions described above have reduced the cross-sectional area of the mains and increased friction/head loss. Deterioration of the mains has also resulted in uneven interior pipe surfaces. As a result more energy is required to pump and deliver the water through the distribution system.

The new mains are 8-inch ductile iron (DI). They will not have the same scaling and deterioration issues as the old mains. Therefore friction/head loss will be minimized. The energy savings from pumping and delivering water through the new mains versus the old mains is estimated at 13,500 KwH/year.

DWRF PROJECT PLAN

FOR THE

WATER SYSTEM UPGRADES AND IMPROVEMENTS

IN THE

City of South Lyon

MAY 1, 2009

Prepared by:

HUBBELL, ROTH & CLARK, INC.
Consulting Engineers
555 Hulet Drive • P.O. Box 824
Bloomfield Hills, MI 48303-0824

Section I - Executive Summary

A. Summary

The Project Plan was prepared in accordance with the Michigan Department of Environmental Quality (MDEQ) *Drinking Water Revolving Fund Project Plan Preparation Guidance* (DWRF) (December 2008). It is based substantially on previous reports prepared by Hubbell, Roth & Clark, Inc. (HRC) entitled *Water Reliability Study for City of South Lyon* (March 2007, Final) and *Hydraulic Water Model Report City of South Lyon* (both of which can be found in Appendix A of this Project Plan). Financial assistance for this project is being sought through the Michigan Department of Environmental quality (MDEQ). The DWRF provides for financial assistance in the form of low interest loans. DWRF rules call for compliance with basic Federal planning requirements of the National Environmental Policy Act (NEPA). The Final Project Plan serves as a basis for project prioritization by the MDEQ.

The project is submitted as a single project and would require approximately two years to implement and complete, including design, permit acquisition, bidding, financing, construction, and final restoration.

The study area consists of the City of South Lyon, which currently provides potable water to its customers through a local municipal well system and private municipal water treatment facility. Although the City has been proactive in the maintenance and improvements of the water system during past improvement programs there are several concerns about the existing system including its age, reliability, capacity, pressure deficiencies, insufficient fire flows and prevalent water main breaks. In the *Hydraulic Model Report*, the existing well and distribution system was extensively modeled, and deficiencies were identified, most notably, the existence of 4" and 6" cast iron mains in service for more than 60 years which results in the inability to meet minimum functional pressures. Furthermore, normal pressure fluctuations from system demands and standard operational practices of valve maintenance and system flushing are often the cause for breaks in the brittle cast iron pipe distribution network which makes up the majority of the 4" and 6" mains within the City center core.

Section II - Project Background

A. Summary of Project Need

One of the major problems with the City of South Lyon water system consists of deficient water pressures and an excessive amount of water main breaks in areas that are still serviced by 4" and 6" cast iron mains which have been in service for over 60 years. This has led to water system reliability uncertainties, water quality concerns and safety concerns. Within a water system that exhibits low distribution system pressures and excessive amounts of water main breaks, it is conceivable that the quality of water in the distribution system could be compromised. Secondarily, areas of low pressure within a water system also causes safety concerns as required flows for fire fighting are usually not available. A hydraulic water model has been completed City-wide to determine the areas of low pressures within the City and a comprehensive history of the size, location, and year in which water main breaks occurred in the City has been cataloged.

The Hydraulic Water Model confirmed the City's suspicions regarding pressure deficiencies within the 4" and 6" water mains as the primary area of concern. A thorough analysis of the Project Area was prepared for this Project Plan and recommendations for resolving the problems within this area are presented herein. Implementing the recommended improvements will effectively address the reliability, quality, and safety concerns.

1. Compliance with the drinking water standards

Upgrades to the existing South Lyon Water Treatment Facility (SL-WTF) are necessary at this time to meet current regulatory standards for water works treatment facilities. In particular, this project is intended to provide for the necessary system maintenance and to bring the SL-WTF into compliance with the Recommended Standards for Water Works (Ten States Standards – 2007 Edition), the Michigan Safe Drinking Water Act, 1976 PA 399, as Amended, and the Administrative Rules as set forth by the Michigan Department of Environmental Quality enacted by the People of the State of Michigan.

2. Orders or Enforcement Actions

There are no current or archived court or enforcement orders against the water supplier or the City of South Lyon.

5. **Plant Piping**

Chemical piping at the SL-WTF is made of PVC, rubber or steel. The PVC and rubber piping are replaced annually. The steel pipes are inspected periodically and replaced if needed.

6. **Conveyance System**

The distribution system of the City of South Lyon consists of approximately 55 miles (290,400 ft) of water main and dates back to the early 1900s. Of South Lyon's 55 miles of water main, approximately 7 miles, or 13% of the system is 4" or 6" mains. Table 2-4 shows the length of water main by pipe diameter in the South Lyon distribution system.

The City has periodically updated and replaced some of the older mains with new 8"-12" ductile iron mains, although many areas are still serviced by 4" or 6" cast iron mains which have been in service for over 60 years. Chemical conditions have caused scaling on the inside of many of the pipes, decreasing the inside pipe diameters. The City has compiled a list of water main breaks from 2000 to present, as shown in Figure 2-7.

Table 2-4: Water Main Length by Pipe Diameter

Pipe Diameter (in)	Length (ft)
4"	12,294
6"	26,064
8"	133,464
10"	109
12"	109,164
16"	9,253
24"	64
Total	**290,413**

The current distribution system provides service to the majority of the area within the South Lyon city limits. It is not expected that the distribution system will be significantly expanded in the future.

7. **System Design Capacity**

The current design capacity of the South Lyon waterworks system is 4.9 MGD. Existing water demands on the system are shown in Table 2-5.

Table 2-5: Existing Water Demands

Year	Average Daily Pumpage	Maximum Day			Minimum Day		
		Pumpage (MGD)	Date	Factor	Pumpage (MGD)	Date	Factor
2003	1.43	3.27	July	2.29	0.95	Jan	0.663
2005	1.41	3.49	August	2.47	0.69	Oct	0.492
Average (MGD)	**1.42**	**3.38**		**2.38**	**0.82**		**0.578**
Average (GPM)	**986**	**2,347**			**570**		

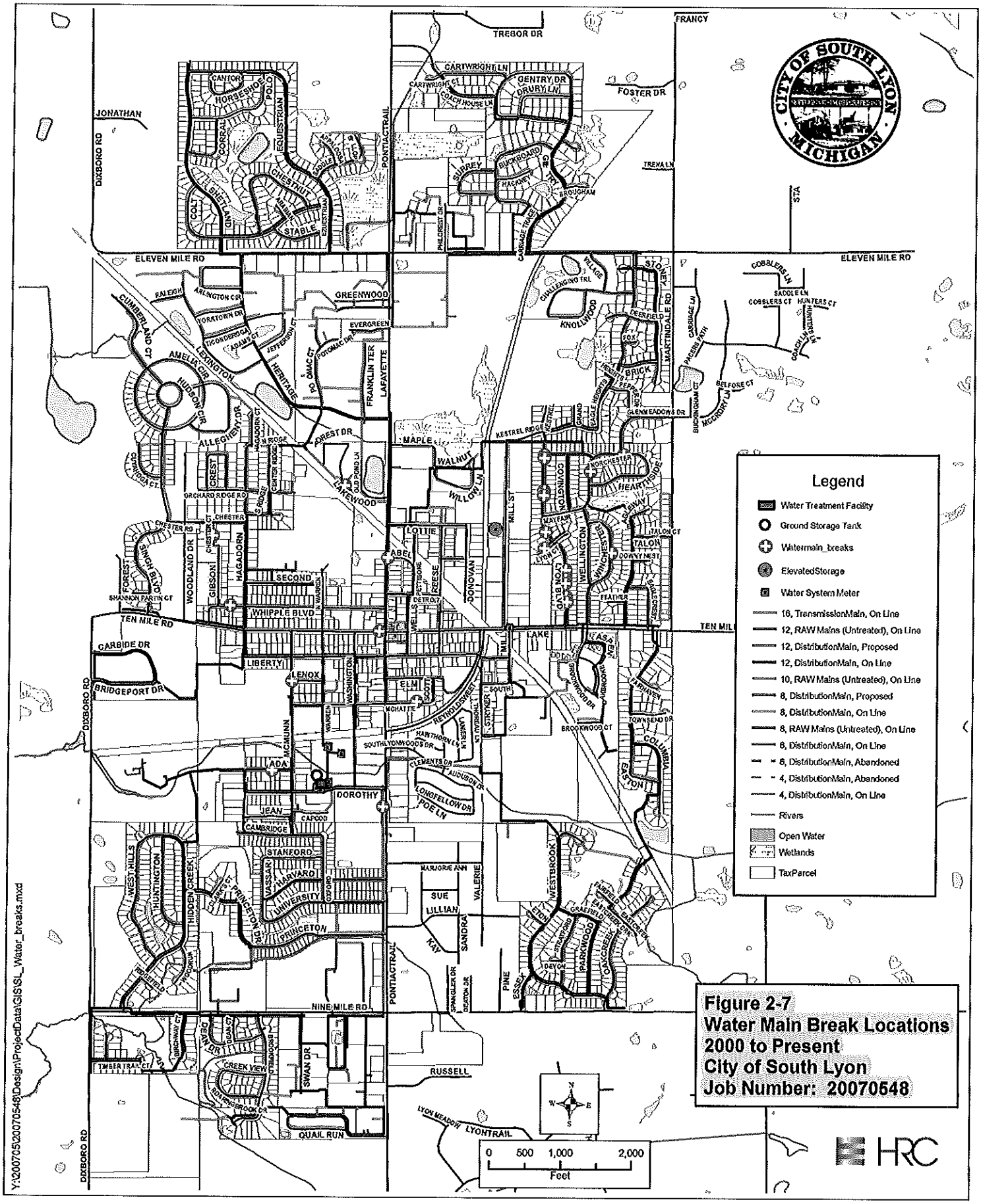
8. **Operation and Maintenance**

Currently, maintenance of the distribution system is performed on a reactionary basis to problems or pressure issues that may occur as a result of undersized or aging water mains. Ground storage tank and elevated storage tank maintenance is performed periodically, and inspection/maintenance will be required for each in the near future.

9. **Reliability**

The SL-WTF and five Well Houses are served by one Detroit Edison electric service. The water plant and Well Houses No. 1 through 4 are fed by a 480 volt 3 phase secondary service via an outdoor switchboard. Well House No. 5 is fed via a 480 volt, 3 phase motor control center in the SL-WTF.

An outdoor stand by electric generator set is located on the site next to the outdoor switchboard. This 550 kW, 480/277 volt, 3 phase generator set is intended to provide standby power to the outdoor switchboard through a built-in automatic transfer switch. The generator however has out-lived its useful life and is not a reliable backup should a power failure occur. A separate manual transfer switch and a lug box are also provided for connection of the outdoor switchboard to a portable generator in the event of a failure of the outdoor generator set.


CITY OF SOUTH LYON
MICHIGAN
Legend
Water Treatment Facility
Ground Storage Tank
Watermain_breaks
ElevatedStorage
Water System Meter
16, TransmissionMain, On Line
12, RAW Mains (Untreated), On Line
12, DistributionMain, Proposed
12, DistributionMain, On Line
10, RAW Mains (Untreated), On Line
8, DistributionMain, Proposed
8, DistributionMain, On Line
8, RAW Mains (Untreated), On Line
6, DistributionMain, On Line
6, DistributionMain, Abandoned
4, DistributionMain, Abandoned
4, DistributionMain, On Line
Rivers
Open Water
Wetlands
TaxParcel
0 500 1,000 2,000
Feet
Figure 2-7
Water Main Break Locations
2000 to Present
City of South Lyon
Job Number: 20070548
HRC
Y:\20070520070548\Design\ProjectData\GIS\SL_Water_breaks.mxd

Section IV - Selected Alternative

The Upgrade and Improvement of the Distribution and Treatment System is the alternative preferred for the implementation of the Water System Improvements. The following improvements are recommended:

- Upgrade the existing 4" and 6" water mains.
- Elevated and Ground Storage Tank Maintenance.
- Upgrade Existing WTF Backup Power System.
- Remove and Replace Induced Draft Aerator.
- Install Additional Lower Service Pump.
- Investigate Potential New Well Site.

A. Description

Upgrade the existing 4" and 6" water mains

In order to address areas of low working pressures as indicated by the Hydraulic Model Report (See Appendix A) and to prevent increasing maintenance and repair costs, all the remaining 4" and 6" distribution mains will be replaced with 8" diameter water mains.

Elevated and Ground Storage Tank Maintenance

As part of the maintenance schedule for the storage tanks, internal and external inspections are required every 5 years. These maintenance tasks include internal tank inspections of both of the tanks, re-painting the exterior of the Elevated Storage Tank and re-coating and rehabilitation work of the interior and exterior of the concrete Ground Storage Tank.

Upgrade existing WTF Backup Power System

The existing backup generator located at the Water Treatment facility is beyond its useful life and replacement is required. The new 3 phase generator will provide standby power to the outdoor switchboard through a built-in automatic transfer switch.

Remove and Replace Induced Draft Aerator

The oldest existing induced draft aerator is 860 gpm and was originally installed in the 1965 filtration plant construction project. This aerator was abandoned in place in 1999 once the new 2,260 gpm was installed. Removal and replacement the 860 gpm aerator will enable operation

Mitigation of Environmental Impacts

See Section V and VI for the discussion of the Mitigation of Environmental Impacts which is anticipated to be minimal with the implementation of the selected alternative.

Schedule for Design and Construction

To construct the above listed improvements the City of South Lyon anticipates a two year phased project. See detailed scheduled in Appendix B.

B. Transmission System Documentation

A hydraulic model (See Appendix A) was prepared for the City of South Lyon water system to evaluate the City's existing and future water demands and to provide a comprehensive overview of the system pressures and fire protection capabilities. From the hydraulic model, system pressures were computed and a capacity analysis was completed. The model results concluded that the City of South Lyon water distribution system is able to sustain acceptable system pressure under current and projected demand conditions. However while the existing water system possesses sufficient capacity to supply its customers there are areas in the City that do not maintain a normal working pressure of 60 to 80 psi as required per Ten States Standards. Undersized and deteriorated 4" and 6" water mains along with topographic variances are the most probable causes for the pressure deficiencies.

As previously indicated herein, the Project Area is generally fully developed or built out with the exception of a few small vacant tracts of industrial property. Some redevelopment may occur, however current land use is expected to remain as is. The current system, improved as proposed, has the capacity to absorb any minimal redevelopment that will occur within the 20 year planning period. This is verified by the results of the Hydraulic Model Report.

C. New Well Construction

In order to maintain the production of safe potable drinking water to the residents of the City of South Lyon construction of another well site in a separate aquifer is necessary. The source of supply for the City of South Lyon is currently a single groundwater aquifer which has provided high quality water via the five (5) existing raw water wells. Wells 1 - 4 were constructed in 1954, and Well 5 was constructed in 1999. Because all five (5) wells draw from the same source, the potential for universal contamination of the water supply is significant, were that source to become contaminated. The construction of a new well site, outside of the 10-year

Section V - Evaluation of Environmental Impacts

A. General

The direct and indirect impacts of the selected alternative on cultural and natural resources must also support the recommendations of the Project Plan. In this section, a comprehensive overview and evaluation of any potential impacts that may occur as a result of the selected alternative must be completed. These include both the beneficial and adverse impacts of the selected alternative for both the short and long-term.

1. Beneficial Long-Term Impacts

The principal beneficial long term environmental impacts resulting from the construction of the proposed water mains will be the increased reliability in the water system, minimization of potential water quality problems, improvement of fire protection, and possible reduction of operation and maintenance costs. Increasing the reliability of the water system, reducing the occurrence of water main breaks, replacing an aging infrastructure, and increasing system pressures will improve consumer confidence, enhance the quality control of the City's drinking water, and minimize potential water quality problems for the residents of the City of South Lyon.

2. Adverse Long-Term Impacts

All of the proposed water main construction is underground resulting in only short term adverse impacts typically associated with typical infrastructure construction.

3. Beneficial Short-Term Impacts

The principal beneficial short term environmental impact resulting from the construction of the proposed water mains is the same as the long term; the increased reliability of the water system, minimization of potential water quality problems, and resolution of safety concerns regarding fire protection.

4. Adverse Short Term Impacts

The primary short term adverse impacts of the proposed project are similar to any construction project. These include noise, dust, traffic disruption, and soil erosion. The primary impact to adjacent properties and businesses will be during the reconnection of their